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Diet Quality of Middle Age and Older Women from Primorsko-Goranska County Evaluated by Healthy Eating Index and Association with Body Mass Index

Gordana Kenđel Jovanović[1], Sandra Pavičić Žeželj[1], Đulija Malatestinić[2], Ines Mrakovčić Šutić[3], Vesna Nadarević Štefanac[4] and Fedor Dorčić[4]

[1] Department of Health Ecology, Teaching Institute of Public Health of Primorsko-Goranska County, Rijeka, Croatia
[2] Department of Social Medicine, Teaching Institute of Public Health of Primorsko-Goranska County, Rijeka, Croatia
[3] Department for physiology and immunology, School of Medicine, University of Rijeka, Rijeka, Croatia
[4] Croatian Institute for Health Insurance, Branch-Office Rijeka, Rijeka, Croatia

A B S T R A C T

Accorded dietary habits provide adequate nutrient intakes, especially important for quality aging. Adequate nutrition for older persons has vital influence on maintaining good health and social functioning. Therefore, using simple tool for evaluation of diet of older population in relation to overweight and obesity is of public health importance. Among many factor that influence quality of aging has obesity, where in Croatia the prevalence of obesity is greater in older women than men. Our aim was to evaluate diet quality of middle age and older women from Primorsko-Goranska County by Healthy Eating Index (HEI) and to see the association of HEI to overweight and obesity. Diet quality of 124 women with average age 59.91±5.31 years was graded with 10 component HEI score, ranging from 0 to 100, where HEI score less than 51 implies »poor« diet. Overweight and obesity was classified according to WHO classification. The majority of women had diet that »needs improvement« (66.1%), and only 3.2% had »good« diet. Older women had better HEI score than middle-aged women, while overweight was statistically significant positively related to better HEI score (β=0.26, p=0.048). Older women better scored for meat, dairy, cholesterol and dietary variety. »Poor« diet mostly had women with normal weight and middle-aged. Age did not influenced overall HEI score, neither its components. Obese women had lower achievements for almost all recommended HEI components. Women having »poor« diet quality could raise a chance for overweight and obesity for almost two times ([OR]=1.67, 95%[CI]=1.072–2.59, p=0.023; [OR]=1.51, 95%[CI]= 1.08–2.10, p=0.015, respectively). The provided results showed that with age, women tended to have better diet. These could be because of that with aging are higher disease incidences that essentially need diet improvements; so older women tended to improve their diet to reduce disease discomforts. Being obese influenced the diet quality of our sample of women, therefore, for quality aging, the importance of public health nutrition programs are strongly needed. HEI score is a good assessment for diet quality, but further investigation of influence on other sociodemographic and health characteristics is required.

***Key words**: older, women, overweight, obese, healthy eating index*

Introduction

Accorded dietary habits provide adequate nutrient intakes, especially important for quality aging[1]. Adequate nutrition for older persons has vital influence on maintaining good health and social functioning, and the relationships between diet and health are of crucial social and economic significance. The International Obesity Task Force (IOTF) and the European Association for the Study of Obesity (EASO) have collected data showing

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that in many European countries more than half of all adults are overweight and up to 30% are clinically obese[2], suggesting that men are more likely to be overweight but women are more likely to be obese. The anthropometrical data from Croatian health survey conducted in 2003 on adults aged 18 to 74 indicate on rising number of overweight and obese persons, and on regional differences[3]. On average, 38.7% of women and 46.7% of men were overweight, but 22.7% of women (regional 15–26%) and 21.6% of men (regional 17–25%) were obese. Significant rise was observed in groups over 40 years, mainly among 50 to 70 years, where there was 28 to 32% obese. Data from that survey in other study showed that central obesity was much more prevalent in women than in men, with more than a half of the adult female population being centrally obese[4]. Overweight and obesity is the major public health problem in most of the countries, and on basis of mentioned data, is an uprising problem in our country[3,5]. Female gender, overweight and obesity had statistically significant positive value for the presence of cardiovascular factors in study conducted among residents in Croatian Islands[6]. The obesity in women from Western region of Croatia was a higher prevalent risk for cardiovascular disease than in men as shown by Croatian cross-sectional study focused on cardiovascular diseases risk[7] and they showed statistically higher prevalence of obesity in women than men by aging. According to results of study on regional dietary differences in Croatia, the prevalence of unhealthy diet reached one quarter of the adult inhabitants of Croatia, and authors showed that lowest of unhealthy dietary pattern was in the Coastal region and City of Zagreb, assuming that this could be due to Mediterranean diet still retain in diet and due to better socio-economic status and education[8].

The assessing of overall dietary patterns is important in exploration of the relationship between diet and health status, so a diet quality indicator is highly desirable. The Healthy Eating Index (HEI) assess diet quality based on 10-component system assembled of five food group, four nutrients, and a measure of variety in foods intake[9]. Since HEI criteria are based on *Food Guide Pyramid (FGP)* and *Dietary Guidelines for Americans*[10] which are simple to use, and are aimed to reduce the risk of chronic diseases related to overweight and obesity, we hypothesized that lower HEI score could be related to overweight and obesity. On basis of mention above, the aim of this study was to evaluate diet quality of middle age and older women from Primorsko-Goranska County using HEI scoring and to see the association of HEI to overweight and obesity.

Subjects and Methods

Subjects

The women that participated in our study were collected from larger project »Osteoporosis study among women from town Rijeka« that included 535 women age 30 to 82 years. For this study aims, we focused on those women from 51 years and older. On basis of questionnaires usefulness, the study sample was consisted of 124 women aged from 51 to 70 years. Physiotherapists measured body weight and height using transportable electronic scale (SECA, Hamburg, Germany), for weight accuracy ±0.1 kg, and height ±0.5 cm. From measured body weight and height, the body mass index (BMI) was calculated as weight divided by height in meters squared (kg/m^2). We defined three weight categories on basis of WHO classification for adults older than 18 years[11] as follows: normal weight (BMI of 18.5–24.9 kg/m^2), overweight (BMI 25.0–29.9 kg/m^2) and obesity (BMI of 30 kg/m^2 or greater). Women with BMI of 18.4 kg/m^2 or under were excluded from study.

Dietary instrument

Dietary intake data were obtained from validated Food Frequency Questionnaire (FFQ)[12]. Provided data were converted into quantities using Croatian tables of chemical composition of foods and drinks[13,14]. The women noted their consumption of offered food items, frequency intake ranged from once per month to once or few times per day and portion of food items estimated from drawings of three portion sizes of each food group or meal presented by trained dietitians.

Healthy Eating Index

The Healthy Eating index is structured of 10 dietary components that weighted equally and are summed to make overall HEI score. Half of dietary components measure how diet conforms to the 5 main pyramid food group servings of grains, vegetables, fruit, milk, and meat/beans, and the other half dietary components measure intakes of total fat, saturated fat, cholesterol, sodium, and dietary variety[15]. The overall HEI score is a sum of the overall diet quality of individual according to the *FGP* that translates recommendations from the *Dietary Guidelines for Americans*[10] into types and amounts of foods people can eat to have a healthful diet. The recommended number of pyramid servings for the five food groups depends on a person's caloric requirement[16]. On that basis we used weighted estimations of HEI dietary components according to the recommended energy intakes for women aged ≥51 years (i.e. 1,900 kcal). The more detailed description of HEI and coding is described elsewhere[9,16–18]. The maximum overall HEI score for all 10 dietary components (0–10 point each) is 100 points. An HEI score less than 51 assumed a »poor« diet, HEI score between 51 and 80 assumed diet that »needs improvement« and HEI score over 80 a »good« diet.

Statistical analysis

Descriptive statistics of anthropometrics and dietary components were given as mean±SD and absolute frequencies. Differences between categorical variables were tested with χ^2-test. The multifactorial variance analysis (ANOVA) was used for multiple group comparison. Logistic regression was carried out to indicate the increase in the odds ratio to became overweight and obese by having a »poor« diet, i.e. not eating according to recommen-

dations for each decrement of HEI score regarding overweight and obesity. All results were considered statistically significant at $p<0.05$. For all statistic methods we used STATISTICA, version 7.1 (StatSoft, Inc., Tulsa, OK, USA).

Results

The age and anthropometrics of women by age and by body mass index distribution are given in Table 1. As shown, there were statistically more middle age women ($p=0.013$) and they had greater BMI ($p=0.005$). When distributed according to BMI classification, there were more overweight women, while those with normal weight and obese women distributed almost equally, and their average age was almost similar. As expected, the BMI statistically significantly differed ($p<0.001$). In Table 2 are mean scores of HEI dietary components and overall HEI score by age and by body mass index distribution, and also the proportion of women by same distributions across HEI categories of diet quality (»good«, »needs improvement« and »poor«). There were no significant differences according to age in HEI dietary components and overall HEI score. Older women had better overall HEI score and better scored for meat, dairy, grains, cholesterol, sodium and had better dietary variety. Middle age women better scored for fruits, vegetables, total and saturated fats. With regard to BMI, overweight women had greatest overall HEI score and better scored for intake of meats, fruits, vegetables, cholesterol, sodium and dietary variety. Women with normal weight better scored for dairy, grains, total and saturated fats, while obese women had almost all scores lowest. There was significant difference in sodium between normal weight and overweight ($p=0.031$), and in overall HEI score between overweight and obese women ($p=0.012$). Regarding dietary components, our women didn't achieve the maximum score of any HEI component. The highest achievement was for fruits, cholesterol and dietary variety, half for grains, dairy and total fats, but only third for saturated fats. Lowest scores were among obese and middle-aged women. Our sample of women mostly had diet that »needs improvement«, on average two thirds, and statistically significant very small proportion of women with »good« diet ($p<0.001$). About one third of all women had »poor« diet and was mainly in groups with overweight and obesity and among middle aged. When distributed by age, »good« diet quality appeared in very small proportion, slightly more in middle age women. There were statistically significantly more middle age women with diet that »needs improvement« ($p=0.002$) and with »poor« diet ($p=0.004$). By BMI classification, on average, women mostly had diet that »needs improvement« with no statistical significance according to nutritional status. Interestingly, there were no women with »good« diet among obese group, while on equally women with »good« diet distributed among normal weight and overweight. There were more women with »poor« diet among overweight and obese. By HEI classification, those with »good« diet had lowest BMI values (24.17 kg/m^2), those with diet that »needs improve- ment« had on average 27.29 kg/m^2 and BMI of those with »poor« diet was 29.89 kg/m^2. To see the influence of HEI score to nutrition status, we run regression analysis of influence of HEI score on BMI. The results showed significant positive relation of better HEI score to overweight ($\beta=0.26$, $p=0.048$), negative, but not significant to obesity ($\beta=-0.12$, $p=0.487$). Normal weight showed small positive relation to BMI ($\beta=0.01$, $p=0.952$). The odds ratios for occurrence of overweight and obesity across the HEI categories are presented in Table 3. Those estimations were adjusted for age using the high HEI score as a referent category (OR=1.00). As a HEI score decrease there was a likelihood of being overweight and obese with statistical significance ($p=0.023$, $p= 0.015$, respectively). The odds of overweight and obesity among women having a »poor« diet were almost twice more than women having a »good« diet. So, women with highest HEI score were almost two times more likely to have »good« diet, no matter being overweight or obese.

Discussion

Diet quality analyses using diet quality index regarding nutritional status may reveal dietary habits that have influence on overweight and obesity. Our results showed that diet quality assessed with HEI was better among older women and among overweight, rather than middle age women and those with normal weight. Our sample of women mostly had diet that »needs improve-

TABLE 1
CHARACTERISTICS OF WOMEN BY AGE AND BODY MASS INDEX DISTRIBUTION (N=124) (x±SD)

Parameters	Women			p	Body Mass Index (kg/m^2)			p
	Age 51 years to 64	Age 65 years and over	Total		Less than 25.00	25.00 to 29.99	30.00 or more	
N (%)	94 (75.8)	30 (24.2)	124 (100.0)	0.013*	31 (25.0)	57 (46.0)	36 (29.0)	0.115
Age (years)	59.37±5.87	60.09±5.14	59.91±5.31	0.341	60.29±5.53	60.02±5.36	59.42±5.15	0.784
Weight (kg)	74.99±14.65	69.95±8.73	73.77±13.60	0.002*	60.13±6.05	70.98±5.02	89.93±11.52	<0.001*
Height (m)	1.63±0.06	1.62±0.05	1.62±0.06	0.078	1.63±0.06	1.62±0.05	1.63±0.07	0.429
BMI (kg/m^2)	28.38±5.36	26.74±3.33	27.98±4.98	0.005*	22.59±1.66	27.17±1.37	33.91±4.35	<0.001*

Statistically significant differences established with variance analysis (ANOVA) at $p<0.05$

TABLE 2
HEALTHY EATING INDEX (HEI) COMPONENTS, OVERALL SCORES AND PROPORTION BY HEI CATEGORIES OF WOMEN BY AGE AND BODY MASS INDEX DISTRIBUTION (N=124) (x±SD)

Healthy Eating Index components	Total	Women						
		Age 51 years to 64	Age 65 years and over	p	BMI less than 25.00 kg/m^2	BMI 25.00 to 29.99 kg/m^2	BMI 30.00 kg/m^2 or more	p
N (%)	124 (100.0)	94 (75.8)	30 (24.2)	0.013*	31 (25.0)	57 (46.0)	36 (29.0)	0.115
Meat	6.17±4.28	5.80±4.36	7.33±3.88	0.485	6.29±4.47	6.32±4.38	5.83±4.05	0.857
Dairy	5.77±3.93	5.64±3.90	6.17±4.09	0.711	5.97±3.96	5.61±4.02	5.83±3.87	0.917
Fruits	7.46±4.11	7.61±4.06	7.00±4.28	0.697	7.08±4.39	8.07±3.75	6.77±4.37	0.299
Vegetables	6.57±4.11	6.65±4.11	6.33±4.14	0.919	6.53±4.32	6.67±3.93	6.45±4.28	0.970
Grains	4.64±2.86	4.63±2.95	4.67±2.60	0.445	5.48±2.99	4.56±2.72	4.03±2.88	0.112
Total fats	4.88±2.25	4.89±2.32	4.83±2.07	0.497	5.00±2.89	5.00±1.89	4.58±2.20	0.649
Saturated fats	3.39±3.09	3.40±3.13	3.33±3.03	0.878	3.89±3.40	3.51±3.13	2.58±2.54	0.209
Cholesterol	7.22±3.57	7.02±3.62	7.83±3.39	0.718	7.08±4.08	7.81±3.14	6.29±3.66	0.157
Sodium	5.48±3.46	5.37±3.38	5.83±3.73	0.470	4.52±3.25	6.14±3.41	5.28±3.57	0.031*
Dietary variety	7.54±3.02	7.29±3.17	8.33±2.40	0.089	7.58±3.13	7.98±2.65	6.81±3.41	0.188
Overall HEI	59.11±11.62	58.30±11.63	61.67±11.40	0.936	59.24±12.56	61.67±11.35	54.63±10.64	0.012*
HEI category		N (%)		p		N (%)		p
Good	4 (3.2)	3 (3.2)	1 (3.4)	0.465	2 (6.5)	2 (3.5)	0 (0.0)	0.264
Needs improvement	82 (66.1)	60 (63.8)	22 (73.3)	0.002*	23 (74.2)	35 (61.4)	24 (66.7)	0.426
Poor	38 (30.7)	31 (33.0)	7 (23.3)	0.004*	6 (19.3)	20 (35.1)	12 (33.3)	0.099

* Statistically significant differences established with variance analysis (ANOVA) at $p<0.05$

TABLE 3
ADJUSTED FOR AGE OR OF OVERWEIGHT AND OBESITY ACCORDING TO HEI CATEGORY*

	Women (N=124)				
	Adjusted OR	(95% CI)		Adjusted OR	(95% CI)
Overweight			Obesity		
»Good«	1.00		»Good«	1.00	
»Needs improvement«	1.24	(0.78–1.83)	»Needs improvement«	1.41	(1.03–1.86)
»Poor«	1.67	(1.07–2.59)	»Poor«	1.51	(1.08–2.10)
Trend test	p=0.023		Trend test	p=0.015	

* The high HEI (»good« diet) group was set as a reference category (OR=1.00)

ment« and statistically very small proportion of »good« diet. There were more women with a »poor« diet quality that were middle aged, overweight and obese. Those results are similar to other studies showing that younger people had lower HEI score (worse diet quality), consumed more Western-like diet, while older people with higher HEI score, had more Mediterranean-like diet, which is recommended for prevention of chronic diseases related to overweight and obesity[18–20]. Our sample of women didn't reached maximum of recommendations in any HEI component, and best scored for fruits, cholesterol and dietary variety, with no statistical significant difference, except for sodium between normal weight and obese women. Those results were consistent with results for HEI scoring among adults 60 years and over, where greatest meeting for recommendations for HEI components was for cholesterol and dietary variety, and lowest for grains[17]. Researchers also found that their female participants with better quality diets (high overall HEI scores) had lower BMI values, and those results are consistent with our findings. We found differences in age, where better diet quality occurred by aging. Those findings could be due to the fact that women by age tend to improve their diet as they take care more about themselves, and to reduce disease discomforts if are connected to diet modifications. After analysis of the influence and relationship between HEI score and overweight and obesity it was evident that the mean overall HEI score was significantly lower among obese women when compared to overweight, but not to normal weight women. When

women were classified to HEI categories, the proportion of overweight and obese women was higher among those with diet that »needs improvement« and »poor« diet, but differences were not statistically significant, except according to age, where older women had better diet quality. As a high HEI score indicates good diet quality and dietary habits that are associated to better health outcomes, in our study it was connected to overweight and obesity. We found that »poor« diet that does not follow the *FGP* in our sample of women is significantly associated to overweight and obesity as twice as much than eating by mentioned guide. These results are comparable to results from EU/SENECA study on Nutrition and Health of the Elderly in Europe, where subjects with low diet quality were more overweight in comparison to subjects with high-quality diet[21]. The study on HEI and health outcomes in large cohorts of health professional women found little or no association between HEI and the risk of major chronic disease that could be related to obesity and aging[22]. Researchers found inverse relation between HEI quintiles and BMI, and that is comparable to our findings for HEI score and obesity but not overweight. However, this study was not designed to assess BMI or obesity as outcome variables and was unadjusted for many confounders. The study obstacles concerns on little study sample and on understanding healthy diet as some guide, misconceptions about what »good« and »bad« food are and understanding what the *FGP* really say. On that basis, the implementation of nutrition programs should be more precise on diet guides. The strengths of this study are that our study was based on sample of women, as they have a great role in modeling dietary habits of their family members, and their diet may have a reflection on her family diet quality. Second, our findings contribute to understanding the relationship of diet quality and nutrition status, revealing dietary patterns in this region. Third, we used a validated assessment index to investigate diet quality that was compared to newest dietary guidelines and in our findings was effective in predicting overweight and obesity in relation to diet quality.

Conclusion

Mainly, our results showed that diet habits are related to overweight and obesity, suggesting that not eating according to *FGP* recommendations could raise an chance for overweight and obesity for two times. Being obese influenced the diet quality of our sample of women, therefore, for quality aging, the importance of public health nutrition programs are strongly needed. HEI is a comprehensive diet quality assessment tool, but there are some limitations about information and computations of some dietary components due to FFQ. Further investigation of influence on other sociodemographic and health characteristics on diet quality using diet quality indices is required in a light for »successful« aging. By detecting and understanding the factors that form dietary habits, nutritionists can better direct health programs to those whose diet need improvement.

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G. Kenđel Jovanović

Teaching Institute of Public Health of Primorsko-Goranska County, Department of Health Ecology, Krešimirova 51, 51000 Rijeka, Croatia
e-mail: gogakendel@inet.hr

KAKVOĆA PREHRANE ŽENA U PRIMORSKO-GORANSKOJ ŽUPANIJI SREDNJE I STARIJE DOBI OCIJENJENA HEALTHY EATING INDEKSOM I POVEZANOST SA INDEKSOM TJELESNE MASE

S A Ž E T A K

Usklađene prehrambene navike omogućuju odgovarajući unos hranjivih tvari, osobito važne za kvalitetno starenje. Odgovarajuća prehrana osoba starije dobi je ima vitalni utjecaj za održavanje dobrog zdravlja i društvenog funkcioniranja. Stoga, koristeći jednostavni indeks za određivanje prehrane starije populacije u povezanosti sa prekomjernom težinom i pretilosti je jedna od zadataka javnog zdravstva. Među mnogim čimbenicima koji utječu na kakvoću starenja je pretilost, a u Hrvatskoj je prevalencija pretilosti veća u starijih žena nego muškaraca. Naš cilj bio je ocijeniti kakvoću prehrane žena srednje i starije dobi u Primorsko-goranskoj županiji koristeći Healthy Eating Index (HEI) i vidjeti ima li HEI ocjena utjecaja na prekomjernu težinu i pretilost. Kakvoća prehrane 124 žene prosječne dobi 59,91±5,31 godine, ocijenjena je pomoću HEI ocijene, koji se sastoji od 10 dijelova, raspona od 0 do 100, gdje HEI manji od 51 ukazuje na »lošu« prehranu. Prekomjerna tjelesna težina i pretilost određena je pomoću WHO klasifikacije. Većina žena imala je prehranu koja »treba poboljšanje« (66,1%), a samo 3,2% je imala »dobru« prehranu. Starije žene su imale veći HEI od žena srednje dobi, dok je prekomjerna težina bila statistički značajno pozitivno povezana sa boljim HEI (β=0,26, p= 0,048). Starije žene imale su bolje bodove za unos mesa, mliječnih proizvoda, kolesterola i raznovrsnost prehrane. »Lošu« prehranu većinom su imale žene srednje dobi i normalne težine. Dob nije imala utjecaj na ukupni HEI, niti na njegove dijelove. Pretile žene su imale manji preporučeni unos skoro svih dijelova HEI. Žene sa »lošom« kvalitetom prehrane mogu imati dvostruko veće šanse za prekomjernu težinu i pretilost ([OR]=1,67, 95%[CI]= 1,072–2,59, p= 0,023; [OR]=1,51, 95%[CI]= 1,08–2,10, p=0,015). Dobiveni rezultati ove studije pokazali su da starenjem žene teže ka boljem načinu prehrane, što se može objasniti činjenicom da se starenjem pojavljuje više bolesti koje trebaju bitno poboljšanje prehrane, pa starije žene nastoje poboljšati kakvoću svoje prehrane kako bi smanjile tegobe bolesti. U našoj skupini žena, pretilost utječe na kakvoću prehrane, stoga, za kvalitetno starenje, važnost primjene prehrambenog programa javnog zdravstva je vrlo jaka. HEI je dobra metoda utvrđivanja kakvoće prehrane, ali su potrebna daljnja istraživanja njegovog utjecaja na druge sociodemografske i zdravstvene odrednice.